LXXIII.—*A List of the Species and Subspecies of the Genus* Rhinolophus, *with some Notes on their Geographical Distribution.* By Knud Andersen.

The present paper gives a brief summary of the systematic, phylogenetic, and zoogeographical conclusions at which I have arrived by a study of the bats of the genus *Rhinolophus* preserved in the British Museum and the United States National Museum. For the details that have served as a basis for the conclusions I must refer to my former papers on this subject *.

A Systematic List of the Species and Subspecies.

A. *The* Rhinolophus simplex *Group.*

1. *Rh. simplex*, K. And.—Lombok †.
2. *Rh. megaphyllus*, J. E. Gray.—Eastern Australia; Louisiade Archipelago.
   - 2 *a*. *Rh. megaphyllus* f. *typica*.—Eastern Australia (Queensland, N. S. Wales).
   - 2 *b*. *Rh. megaphyllus monachus*, K. And.—Louisiade Archipelago (St. Aignan's Isl.).
- ? *Rh. keyensis*, Ptrs.—"Key Islands."
3. *Rh. truncatus*, Ptrs.—Batchian.
4. *Rh. nanus*, K. And.—Goram Island.
5. *Rh. celebensis*, K. And.—Celebes (Makassar, Menado).

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* Andersen and Matschie, "Ueber einige geographische Formen der Untergattung *Euryalus*," SB. Ges. naturf. Fr. Berlin, 1904, no. 5, pp. 71–83.
Andersen, "Five new *Rhinolophi* from Africa," Ann. & Mag. Nat. Hist. (7) xiv., Nov. 1904, pp. 378–388.
Id., "On von Heuglin's, Rüppell's, and Sundevall's Types of African *Rhinolophi*," *t. c.*, Dec. 1904, pp. 451–458.
Id., "Further Descriptions of new *Rhinolophi* from Africa," *op. cit.* (7) xv., Jan. 1905, pp. 70–76.
Id., "On the Bats of the *Rhinolophus philippinensis* Group, with Descriptions of Five new Species," *op. cit.* (7) xvi., Aug. 1905, pp. 243–257.
Id., "On the Bats of the *Rhinolophus arcuatus* Group, with Descriptions of Five new Forms," *t. c.*, Sept. 1905, pp. 281–288.
Id., "On the Bats of the *Rhinolophus macrotis* Group, with Descriptions of Two new Forms," *t. c.*, Sept. 1905, pp. 289–292.
Id., "On some Bats of the Genus *Rhinolophus*, with Remarks on their Mutual Affinities, and Descriptions of Twenty-six new Forms," Proc. Zool. Soc. 1905, ii. (Oct.) pp. 75–145, pls. iii., iv.

† When not otherwise stated, the record of the geographical distribution of the species and subspecies is based exclusively on examples examined by myself (a few localities quoted from literature are printed between inverted commas).

6. *Rh. borneensis*, Ptrs.—N. Borneo; S. Natunas; Karimata Archipelago.
   6 *a*. *Rh. borneensis* f. *typica*.—N. Borneo; Labuan; Banguey.
   6 *b*. *Rh. borneensis spadix* *, Miller.—S. Natunas (Sirhassen); Karimata Archipelago (Karimata, Pulo Sarutu).
7. *Rh. virgo*, K. And.—Luzon.
8. *Rh. malayanus*, Bonhote.—Malay Peninsula (Jalor); ? Siam (Laos Mts.).
9. *Rh. nereis*, K. And.—Anambas Archipelago (Pulo Siantan).
10. *Rh. simulator*, K. And.—Mashonaland (Mazoe).
11. *Rh. Denti*, Thos.—Bechuanaland (Kuruman); Wakkerstroom (Zuurbron).
12. *Rh. stheno*, K. And.—Malay Peninsula (Selangor, Penang).
13. *Rh. Rouxi*, Temm.—From S. China, through the Himalayas, to the Indian Peninsula and Ceylon.
   13 *a*. *Rh. Rouxi sinicus*, K. And.—Lower Yangtse Valley.
   13 *b*. *Rh. Rouxi* f. *typica*.—Himalayas (Darjeeling, Nepal, Masuri); S. India (Nilghiri, Kanara); Ceylon.
14. *Rh. capensis*, Lchtst.—S. Cape Colony.
15. *Rh. Thomasi*, K. And.—Burmah (Karin Hills).
16. *Rh. affinis*, Horsf.—From the N.W. Himalayas to S. China; through Indo-China, the Malay Peninsula, and N. Natunas, to Sumatra, Java, and Lombok.
   16 *a*. *Rh. affinis himalayanus*, K. And.—Himalayas (Masuri, Nepal, Darjeeling); S. China (Nanking).
   16 *b*. *Rh. affinis tener*, K. And.—Pegu.
   16 *c*. *Rh. affinis macrurus*, K. And.—Burmah (Karin Hills).
   16 *d*. *Rh. affinis superans*, K. And.—Lower Siam; Malay Peninsula; Sumatra.
   16 *e*. *Rh. affinis nesites*, K. And.—N. Natunas (Bunguran Isl.).
   16 *f*. *Rh. affinis* f. *typica*.—Java.
   16 *g*. *Rh. affinis princeps*, K. And.—Lombok.
17. *Rh. andamanensis* †, Dobson.—S. Andamans.
18. *Rh. clivosus*, Cretzschm.—"Arabia (Mohila)"; Berbera.
19. *Rh. Darlingi*, K. And.—Mashonaland (Mazoe); Angola.
20. *Rh. acrotis*, Heugl.—From Erythrea to Lower Egypt.
   20 *a*. *Rh. acrotis* f. *typica*.—Erythrea.
   20 *b*. *Rh. acrotis Andersoni* ‡, Thos.—Eastern Egyptian Desert.
   20 *c*. *Rh. acrotis brachygnathus*, K. And.—Lower Egypt.
21. *Rh. ferrum-equinum*, Schreb.—From S. China and Japan, through the Himalayas, the Mediterranean Subregion (exclusive of Egypt) and Central Europe, to S. England.
   21 *a*. *Rh. ferrum-equinum nippon*, Temm.—S. China (Shanghai); Pt. Hamilton; Japan.
   21 *b*. *Rh. ferrum-equinum tragatus*, Hodgs.—Darjeeling; Nepal.
   21 *c*. *Rh. ferrum-equinum regulus*, K. And.—Almora; Masuri.
   21 *d*. *Rh. ferrum-equinum proximus*, K. And.—Gilgit.
   21 *e*. *Rh. ferrum-equinum* f. *typica*.—From Transcaspia and the Euphrates Valley, through Southern and Central Europe, exclusive of the Spanish Peninsula.
   21 *f*. *Rh. ferrum-equinum obscurus*, Cabrera.—Spanish Peninsula (with Balearics); Algeria.

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* Doubtfully distinct from the typical form of *Rh. borneensis*.
† Perhaps a local form of *Rh. affinis*.
‡ Doubtfully distinct from the typical *Rh. acrotis*.

22. *Rh. augur*, K. And.—Orange River tract; Natal; Lower Zambesi.
    22 *a*. *Rh. augur* f. *typica*.—Orange River tract (Transvaal, Orange River Colony, Bechuanaland, Namaqualand).
    22 *b*. *Rh. augur zuluensis*, K. And.—Zululand; Natal; Pondoland; K. Williamstown.
    22 *c*. *Rh. augur zambesiensis*, K. And.—Lower Zambesi tract (Mazoe, Nyasa).
23. *Rh Deckeni*, Ptrs.—Ukambani tract; Zanzibar coast.

B. *The* Rhinolophus lepidus *Group.*

24. *Rh. lepidus*, Blyth.—S. India (Wynaad); Ganges Valley.
25. *Rh. monticola*, K. And.—Masuri.
26. *Rh. refulgens*, K. And.—Malay Peninsula (Perak, Selangor).
27. *Rh. acuminatus*, Ptrs.—Java; Lombok.
    27 *a*. *Rh. acuminatus* f. *typica*.—Java.
    27 *b*. *Rh. acuminatus audax*, K. And.—Lombok.
28. *Rh. sumatranus*, K. And.—Sumatra.
29. *Rh. calypso*, K. And.—Engano.
30. *Rh. minor*, Horsf.—Java; ? Siam; ? Darjeeling.
31. *Rh. minutus*, Miller, nec Montagu.—Anambas Archipelago.
32. *Rh. cornutus*, Temm.—Japan.
    32 *a*. *Rh. cornutus pumilus*, K. And.—Loo-choo Islands (Okinawa); ? S. China (Foochow).
    32 *b*. *Rh. cornutus* f. *typica*.—Japan proper.
33. *Rh. gracilis*, K. And.—Malabar coast.
34. *Rh. subbadius*, Blyth.—"Nepal"; "Assam (Garo Hills)."
35. *Rh. monoceros*, K. And.—Formosa.
36. *Rh. empusa*, K. And.—Nyasa.
37. *Rh. Andreinii* *, Senna.—"Erythrea."
38. *Rh. Blasii*, Ptrs.—Mediterranean Subregion.
39. *Rh. Landeri*, Martin.—Fernando Po; Gaboon.
40. *Rh. lobatus*, Ptrs.—Zambesi tract (Shupanga, Shire, Nyasa); Ukambani tract.
41. *Rh. Dobsoni*, Thos.—Kordofan.
42. *Rh. euryale*, J. H. Blasius.—Mediterranean Subregion.
    42 *a*. *Rh. euryale judaicus*, K. And. & Mtsch.—Euphrates Valley; Palestine; Lower Egypt.
    42 *b*. *Rh. euryale Mehelyi*, Mtsch.—Dobrudsha; N. Bulgaria.
    42 *c*. *Rh. euryale* f. *typica*.—Dalmatia; Po Valley; Liguria.
    42 *d*. *Rh. euryale tuscanus*, K. And. & Mtsch.—Tuscany (Pisa); Latium (Roma).
    42 *e*. *Rh. euryale carpetanus*, Cabrera.—Guadiana Valley.
    42 *f*. *Rh. euryale Cabreræ*, K. And. & Mtsch.—Tajo Valley (Madrid, Cintra).
    42 *g*. *Rh. euryale atlanticus*, K. And. & Mtsch.—France; Galizia.
    42 *h*. *Rh. euryale barbarus*, K. And. & Mtsch.—Morocco to Tunisia (coast form).
    42 *i*. *Rh. euryale meridionalis*, K. And. & Mtsch.—Algeria (probably mountain form).

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* Stated to differ from *Rh. Blasii* in the shape of the sella (Angelo Senna, "Contributo alla conoscenza dei Chirotteri Eritrei," Archivio Zoologico, ii. pt. 3, pp. 256–260, pl. xvi. fig. 1, pl. xviii. figs. 7–16; Sept. 30, 1905).

C. *The* Rhinolophus midas *Group.*

43. *Rh. midas*, K. And.—Persian Gulf (Jask).
44. *Rh. hipposiderus*, Bechst.—From Gilgit to Ireland, from the Baltic to Sennar.
    44 *a*. *Rh. hipposiderus minimus*, Heugl.—Erythrea and Sennar; the Mediterranean Subregion.
    44 *b*. *Rh. hipposiderus* f. *typica*.—From the extreme N.W. Himalaya (Gilgit), through N.W. Persia (Urmi) and Armenia (Van), over the whole of Central Europe.
    44 *c*. *Rh. hipposiderus minutus*, Montagu.—England; Wales; Ireland.
? *Rh. phasma*, Cabrera.—"Central Spain (Tajo Valley)."

D. *The* Rhinolophus philippinensis *Group.*

45. *Rh. philippinensis*, Waterh.—Philippines.
46. *Rh. achilles*, Thos.—Key Islands.
47. *Rh. mitratus*, Blyth.—"N. India (Chaibassa)."
48. *Rh. Maclaudi*, Pous.—"Conakry Island" (off Senegambia).
49. *Rh. sedulus*, K. And.—N. Borneo; Malay Peninsula (Pahang).
50. *Rh. lanosus*, K. And.—N.W. Fokien.
51. *Rh. trifoliatus*, Temm.—Java; Sumatra; N. Borneo; Malay Peninsula; Lower Siam; Tenasserim.
52. *Rh. solitarius*, K. And.—Banka.
53. *Rh. Beddomei*, K. And.—S. India (Wynaad).
54. *Rh. luctus*, Temm.—Java; N. Borneo; Malay Peninsula.
55. *Rh. geminus*, K. And.—Java.
56. *Rh. perniger*, Hodgs.—Himalayas (Sikkim, Nepal, Masuri).

E. *The* Rhinolophus macrotis *Group.*

57. *Rh. macrotis*, Hodgs.—Masuri; Nepal.
58. *Rh. hirsutus*, K. And.—Philippines.
59. *Rh. æthiops*, Ptrs.—Angola.
60. *Rh. Hildebrandti*, Ptrs.—Zambesi tract (Mazoe, Nyasa); Ukambani tract (Taita, Machakos, Kenya).
61. *Rh. eloquens*, K. And.—Uganda.
62. *Rh. fumigatus*, Rüpp.—British East Africa; Abyssinia; Somaliland; Erythrea.
    62 *a*. *Rh. fumigatus exsul*, K. And.—British East Africa.
    62 *b*. *Rh. fumigatus* f. *typica*.—Abyssinia (Shoa, Adowa); Somaliland (Pozzi Dass, Jifa Medir); Erythrea.
63. *Rh. Pearsoni*, Horsf.—Himalayas, eastwards to Fokien.
    63 *a*. *Rh. Pearsoni* f. *typica*.—Himalayas (Masuri, Darjeeling); "Yunan"; "Szetchuen."
    63 *b*. *Rh. Pearsoni chinensis*, K. And.—Fokien.

F. *The* Rhinolophus arcuatus *Group.*

64. *Rh. arcuatus*, Ptrs.—Philippines.
    64 *a*. *Rh. arcuatus* f. *typica*.—Luzon.
    64 *b*. *Rh. arcuatus exiguus*, K. And.—Zamboanga; Guimarás.
65. *Rh. subrufus*, K. And.—Philippines.
66. *Rh. inops*, K. And.—Mindanao.
67. *Rh. Creaghi*, Thos.—N. Borneo.
68. *Rh. coelophyllus*, Ptrs.—Malay Peninsula (Kedah); "Lower Burmah (Moulmein)"; Upper Burmah (Tsagine).

69. *Rh. curyotis*, Temm.—Batchian; Amboina; Key Islands.
69 *a*. *Rh. curyotis timidus*, K. And.—Batchian.
69 *b*. *Rh. curyotis* f. *typica*.—Amboina.
69 *c*. *Rh. curyotis præstans*, K. And.—Key Islands.

G. *Incertæ sedis.*

(70) *Rh. angolensis**, Seabra.—"Angola (Hanha)."
(71) *Rh. alcyone*†, Temm.—"Gold Coast."

A Geographical Review of the Species, with some Notes on their probable Interrelations.

Bats, as being possessed of a greater facility of locomotion than other mammals, are commonly supposed to be deceptive guides for the zoogeographer. It may well be that this is in part, perhaps chiefly, due to the fact that very often distinct, and sometimes widely distinct, species have been covered by one technical name‡. If we draw the lines of separation between the species (and their local modifications) somewhat more closely in accordance with the lines drawn by nature, we shall, no doubt, find that in most instances bats are as good and reliable zoogeographical guides as other small but non-flying mammals. Such at least is the case with the bats of the genus here under consideration. There is a great similarity between the *Rhinolophus* fauna of N. Borneo and that of the Malay Peninsula (see below), but hardly greater than between the mammalian faunas of these countries in general. In the Philippines, on the other hand, we find a remarkable assemblage of very primitive *Rhinolophi*, most of them essentially different from those of the opposite continent,

* The "lobo central do appendice nasal" is described by Seabra as "*bifurcado* como no *Rh. Blasii*" (Jorn. Sci. Math. Phys. Nat. Lisboa, (2) v. Dec. 1898, p. 250). If this means that the connecting-process is high and pointed and the sella deltoid (triangular, with pointed summit), *Rh. angolensis* is certainly a distinct species and of much interest as a West-African representative of the *empusa* type, which as yet, within the Ethiopian Region, is known from Nyasaland and Erythrea only.

† There is not in the original description of the only known specimen of this bat (Leiden Museum) one single word of any value for identifying the species or determining its affinities. It is as thoroughly unknown as if it had never been recorded.

‡ E. g.: *Rh.* "*ferrum-equinum*," made up of *Rh. ferrum-equinum, augur, acrotis*, and *fumigatus*, and *therefore* distributed over the whole of the Ethiopian and the whole temperate part of the Palæarctic Region; *Rh.* "*affinis*" as a collective name for *Rh. borneensis, stheno, Rouxi*, and *affinis*; *Rh.* "*minor*" for *Rh. lepidus, monticola, refulgens, minor, cornutus, gracilis*, and *subbadius*; &c.

only one species (*hirsutus*), itself a primitive form, being a genuine Himalayan type, though as a species quite distinct; this, again, is perfectly in accordance with the general character of the Philippine fauna. The immigration of Rhinolophine types from south into the Philippines, and the radiation from these islands southwards into the Austro-Indo-Malayan Archipelago, have by no means been greater than of other mammals—rodents, f. i. A very narrow tract of water can form an apparently insurmountable barrier for the spreading of a *Rhinolophus* (*Rh. ferrum-equinum* in England, not in Ireland), as it has formed for the voles. The *Rhinolophus* fauna of Lower Egypt * is markedly different from that of Palestine; not even the direct land-connexion has caused a more extensive interchange of species than in the case of non-flying mammals. All this—and a series of similar instances could be adduced—tends to show that for the spreading of the *Rhinolophi* their power of flight has been a factor of very little importance; their present distribution, like that of non-flying mammals, has been determined by the history of the type to which the species belongs and the geological history of the continent or island in question.

Australia:—*Rh. megaphyllus typicus*.—The only Australian species is most closely related to *Rh. simplex*, from Lombok.

Louisiade Archipelago:—*Rh. megaphyllus monachus*.—The Louisiade form seems to be a not quite perfectly differentiated offshoot of the Australian species.

New Guinea.—As yet no species is known from New Guinea, although the genus is represented both east (Louisiade Archipelago), south (Australia, Key Islands), and west (Moluccas) of the island.

Key Islands:—"*Rh. keyensis*"; *Rh. achilles*; *Rh. euryotis præstans*.—*Rh. achilles* is a peculiar modification of the *philippinensis* type. *Rh. euryotis præstans* has its nearest, scarcely more than subspecifically distinct, allies in Amboina and Batchian. "*Rh. keyensis*," a still very imperfectly known form, is probably closely related to *Rh. simplex* and *megaphyllus*. The *Rhinolophus* fauna of the Key Islands, therefore, points partly north-westwards, to the Moluccas and the Philippines, partly westwards.

* Of the four Palestine species (*Rh. ferrum-equinum, Blasii, euryale judaicus, hipposiderus minimus*), one only (*euryale judaicus*), so far as I know, has spread from the Asiatic side of the Mediterranean to Lower Egypt. The only other species recorded from Lower Egypt (*Rh. acrotis*) is unknown in Syria and Palestine.

Goram :—*Rh. nanus.*—A representative of the common Austro-Malayan *simplex* type.

Amboina :—*Rh. euryotis typicus.*—This form has its closest, only subspecifically distinct, allies to the north (Batchian) and to the south-east (Key Islands) ; but the *euryotis* type belongs to a group of the genus (the *arcuatus* group) which now has its most primitive representatives in the Philippines.

Batchian :—*Rh. truncatus* ; *Rh. euryotis timidus.*—*Rh. truncatus* is a well-marked species of the widely distributed *simplex* type. *Rh. euryotis* points, as already stated, in the last instance northwards, to the Philippines.

Lombok :—*Rh. simplex, Rh. affinis princeps*; *Rh. acuminatus audax.*—*Rh. simplex* seems to be the most primitive member of the section which I have proposed to call the *Rh. simplex* group ; it has very close relatives in (probably) the whole of the Austro-Malayan and Indo-Malayan subregions. *Rh. affinis princeps* is the extreme south-eastern outpost of a species now distributed from the Himalayas through Indo-China, Sumatra, and Java ; the Lombok form seems to be more closely related to the Malacca-Sumatra race (*Rh. a. superans*) than to the Java race (*Rh. a. typicus*). *Rh. acuminatus audax* is a local form of a Java species.

The Austro-Malayan Subregion.—Out of 69 species known, only 8 are found in this subregion (9, if *Rh. keyensis* is regarded as a species). Of these 8 species, two (*Rh. affinis princeps*, *Rh. acuminatus audax*) are south-eastern outposts of Indo-Malayan or Indo-Chinese species. Of the remaining 6 no less than 4 (*Rh. simplex, megaphyllus, truncatus, nanus*) are representatives of the *simplex* type, which also numbers several very primitive species in the Indo-Malayan Archipelago. The last two species (*Rh. achilles* and *euryotis*) can be traced back to the Philippines.

Celebes :—*Rh. celebensis*, a representative of the *simplex* type, in certain cranial characters rather intermediate between the Austro-Malayan and the genuine Indo-Malayan species of the *simplex* group.

Philippines :—*Rh. virgo*; *Rh. philippinensis*; *Rh. arcuatus*, *Rh. subrufus*, *Rh. inops*; *Rh. hirsutus.*—The Philippine *Rhinolophus* fauna is remarkable for its richness in primitive, even extremely primitive, types, and the total absence of highly differentiated forms. *Rh. virgo* is closely related to *Rh. borneensis*, both of them species on a low level of development. *Rh. philippinensis* is the most primitive representative known of the *philippinensis* group; so far as concerns the

dentition, it has apparently remained on a slightly lower level than any other species of the genus. *Rh. arcuatus* and *subrufus* are the most primitive members of the *arcuatus* group; *Rh. inops* a representative of the same group, chiefly characterized by its peculiarly modified sella. *Rh. hirsutus* is a very primitive species of the *macrotis* group, closely related to the Himalayan *Rh. macrotis*.—*Rh. philippinensis* and *Rh. arcuatus* cannot be brought into close genetic connexion with any other known bat; in the absence of palæontological evidence to the contrary, we may therefore regard them as autochthonous Philippine types—*i. e.* as the least modified survivors of types which have originated in the Philippines, or, more likely, in a tract of land of which the Philippines are the relicts. We can still trace their radiation out from that centre: the *philippinensis* type has spread both southwards, to the Key Islands (*Rh. achilles*), and westwards, through India (*Rh. mitratus*) as far as the Ethiopian Region (*Rh. Maclaudi*), while a third offshoot has given rise to the slightly more aberrant Indo-Malayan *sedulus-trifoliatus* branch; the *arcuatus* type has spread southwards and become differentiated into the comparatively rather highly developed Austro-Malayan *Rh. euryotis*. The presence of the *simplex* type (*Rh. virgo*) in the Philippines is evidence of an immigration *into* the islands from the south; the close relationship between the Himalayan *Rh. macrotis* and the Philippine *Rh. hirsutus* points to a former connexion with the continent.

N. Borneo:—*Rh. borneensis* (*typicus*); *Rh. sedulus*, *Rh. trifoliatus*, *Rh. luctus*; *Rh. Creaghi*.—*Rh. borneensis* is a bat of the *simplex* type, slightly more advanced than *Rh. celebensis*. *Rh. sedulus*, *trifoliatus*, and *luctus* are members of the *philippinensis* group; the former species in its cranial characters rather primitive, in its essential external characters close to *trifoliatus*; *Rh. trifoliatus* and *luctus* are more highly developed species of the group. *Rh. Creaghi* is a peculiar modification of the *arcuatus* type.—The fauna points partly (*Rh. borneensis*) eastwards, to Celebes and the Austro-Malayan islands, partly and most decidedly north-eastwards, to the Philippines (all the other species). It is very closely connected with the *Rhinolophus* fauna of the Malay Peninsula, no less than three species (*sedulus, trifoliatus, luctus*) being common to both countries.

S. Natunas and Karimata Archipelago:—*Rh. borneensis spadix*, extremely closely related to (or identical with) the Bornean form of the species.

Malay Peninsula, Lower Siam, South Tenasserim:—*Rh. malayanus*, *Rh. stheno*, *Rh. affinis superans*; *Rh. refal-*

gens; *Rh. sedulus*, *Rh. trifoliatus*, *Rh. luctus*; *Rh. cœlophyllus*.— The first three species belong to the *simplex* group: *Rh. malayanus* is very closely related to *Rh. borneensis*; *Rh. stheno* a more thorough modification of the *borneensis* type; *Rh. affinis superans* is but a local race of a Himalayan species. *Rh. refulgens*, a bat of the *lepidus* group, has its closest relative in the Himalayas (*Rh. monticola*). *Rh. sedulus*, *trifoliatus*, and *luctus*, all of the *philippinensis* group, are common to Borneo and the Malay Peninsula. *Rh. cœlophyllus* is a highly peculiar species of the *arcuatus* group, probably rather closely related to the Bornean *Rh. Creaghi*.— Of the eight species here under consideration, six (*Rh. malayanus*, *stheno*, *sedulus*, *trifoliatus*, *luctus*, *cœlophyllus*) bear evidence of the very close faunistic connexion between Borneo and the Malay Peninsula; the remaining two (*affinis*, *refulgens*) are but slightly modified immigrants from the north.

South Andamans:—"*Rh. andamanensis.*"—Although as yet very imperfectly known, this bat is undoubtedly closely related to *Rh. affinis superans* from the Malay Peninsula.

Sumatra:—*Rh. affinis superans*; *Rh. sumatranus*; *Rh. trifoliatus*.—*Rh. affinis superans* and *Rh. trifoliatus* are common to Sumatra and the Malay Peninsula. *Rh. sumatranus* belongs to a small section of the *lepidus* group, closely connected with *Rh. refulgens* from the Malay Peninsula.

Engano:—*Rh. calypso*.—It is worth noticing that the only *Rhinolophus* as yet known from Engano is closely related to, but specifically distinct from, *Rh. sumatranus*.

Banka:—*Rh. solitarius*, a local representative of the *philippinensis* type, closely allied to, but specifically distinct from, *Rh. trifoliatus* from the Malay Peninsula and Sumatra.

Java:—*Rh. affinis typicus*; *Rh. minor*, *Rh. acuminatus typicus*; *Rh. trifoliatus*, *Rh. luctus*, *Rh. geminus*.—The Java form of *Rh. affinis* seems to be closer related to the Himalayan race than to *Rh. a. superans* from Sumatra and the Malay Peninsula. *Rh. minor* is either identically the same species as found in Siam and Darjeeling or a very closely allied form. *Rh. acuminatus* has no closer relative than *Rh. sumatranus*. *Rh. trifoliatus* and *luctus* are common to Java, Borneo, and Malacca. *Rh. geminus*, a bat of the *luctus* type, is very closely related to the Himalayan *Rh. perniger*.—As a summary: of six species, three (*Rh. affinis*, *minor*, *geminus*) point to a closer faunistic affinity between Java and the Indo-Chinese and Himalayan tracts than between Java and the geographically nearer Sumatra, Malacca, and Borneo; the remaining three are common Indo-Malayan types.

N. Natunas:—*Rh. affinis nesites*, an apparently well-differentiated form, most closely related to *Rh. a. superans* from Malacca.

Anambas Islands:—*Rh. nereis*; *Rh.* "*minutus.*"—The two species point to a connexion both with Borneo and with the continent, the former being an offshoot of the *borneensis* type, the latter of the *minor* type.

The Indo-Malayan Subregion.—Of 69 species known, 26 (38 per cent.) are found in this subregion, and no less than 24 * are, *as species*, apparently autochthonous; of the remaining two, one (*Rh. affinis*) is certainly, the other (*Rh. minor*) probably, Indo-Chinese.—To form a clearer idea of the affinities and probable origin of this fauna it is best, however, to consider the primary groups of species represented within the subregion; we then arrive at the conclusion that all the species of the *simplex* group (seven in number; see footnote) probably, in the very last instance, are descendants of Austro-Malayan types; that the five species of the *lepidus* group and the only species of the *macrotis* group can be ultimately traced back to some part of what we now call Indo-China; whereas the eleven species of the *philippinensis* and *arcuatus* groups may very likely have originated from purely autochthonous types. If this be so, we have as a total result 15 species which (at least as "types") can be traced back to places outside the subregion as against 11 apparently purely autochthonous.

Tenasserim tract (including Karennee):—*Rh. Thomasi*, *Rh. affinis macrurus*; *Rh. cœlophyllus.*—*Rh. Thomasi* is a very peculiar modification of the Chinese and Himalayan *Rouxi* type; *Rh. affinis macrurus* a local representative of a Himalayan species. *Rh. cœlophyllus* has come from the south (Malay Peninsula).

Pegu tract:—*Rh. affinis tener*, very closely related to the Himalayan form of *Rh. affinis*.

Assam tract:—*Rh. subbadius*, also known from Nepal.

South China and Formosa:—*Rh. Rouxi sinicus*, *Rh. affinis himalayanus*, *Rh. ferrum-equinum nippon*; *Rh. cornutus pumilus*, *Rh. monoceros*; *Rh. lanosus*; *Rh. Pearsoni chinensis*.

* Seven species of the *simplex* group: *Rh. celebensis*, *borneensis*, *virgo*, *malayanus*, *nereis*, *stheno*, *andamanensis*. Five of the *lepidus* group: *Rh. refulgens*, *acuminatus*, *sumatranus*, *calypso*, "*minutus*." Six of the *philippinensis* group: *Rh. philippinensis*, *sedulus*, *trifoliatus*, *solitarius*, *luctus*, *geminus*. Five of the *arcuatus* group: *Rh. arcuatus*, *subrufus*, *inops*, *Creaghi*, *cœlophyllus*. One of the *macrotis* group: *Rh. hirsutus*.

—Three of these species (*Rh. affinis, ferrum-equinum, Pearsoni*) are most probably of Himalayan or, at least, Indo-Chinese origin; *Rh. cornutus* has no closer relative than the Himalayan *Rh. minor*; *Rh. monoceros*, known from Formosa only, is a modification of the Himalayan *Rh. subbadius*. Thus, five out of the seven species point westwards; with the two remaining, *Rh. Rouxi* and *Rh. lanosus*, the case is different—the former species, though also found throughout the Himalayas, is most closely related to *Rh. borneensis*, the latter to the Bornean *Rh. sedulus*.

South Korea, Loo-choo Islands, and Japan proper:—*Rh. ferrum-equinum nippon*; *Rh. cornutus*.—Both species are undoubtedly immigrants from China.

Himalayas:—*Rh. Rouxi typicus*, *Rh. affinis himalayanus*, *Rh. ferrum-equinum tragatus* and *regulus*; *Rh. monticola*, *Rh. minor* (?), *Rh. subbadius*; *Rh. perniger*; *Rh. macrotis*, *Rh. Pearsoni typicus*.—Four of these species (*Rh. affinis, ferrum-equinum, macrotis, Pearsoni*) may very likely be of Himalayan origin; the two former have spread far beyond this tract. *Rh. monticola*, *minor* (?), and *subbadius* may also, as species, be of Himalayan origin, but they have slightly more primitive allies in the Indian Peninsula. *Rh. Rouxi* is, as already stated, probably an immigrant from east, derived from the *borneensis* type. *Rh. perniger* is most closely related to *Rh. geminus* from Java.

The Himalayan and Indo-Chinese Subregion (including Korea and Japan).—Of 69 species known, 14 (*i. e.* 20 per cent.) occur in this subregion, but one of them (*Rh. cœlophyllus*) is probably a *direct* immigrant from south. The four forms of the *simplex* group (*Rouxi, Thomasi, affinis, ferrum-equinum*) have, most probably, as species originated within the area; when traced back to their remotest origin, they are descendants of a more eastern type. The same is the case with the representatives of the *philippinensis* group (*lanosus, perniger*). The five species of the *lepidus* group (*monticola, minor, cornutus, subbadius, monoceros*) seem to have a slightly more primitive relative in the Indian Peninsula. *Rh. macrotis* is the only Indo-Chinese species which I fail to trace back to any other known type of the genus*; it may be the very primitive survivor of a genuine (autochthonous) Himalayan type; in any case, its origin evidently

* It is highly probable that the *macrotis* type originated from an ancient *philippinensis*-like bat which had not acquired the peculiar specialization of the nose-leaves characteristic of all the now-existing representatives of the *philippinensis* group (see my paper on the *Rh. macrotis* group, *loc. cit.* pp. 290–292).

dates back to a period when the distribution of land and water in this part of the world was essentially different from what it is nowadays, for we find representatives of the *macrotis* type in the now thoroughly isolated Philippine Islands (*Rh. hirsutus*) and in a vast part of the Ethiopian Region (*Rh. æthiops, Hildebrandti, eloquens, fumigatus*). *Rh. Pearsoni* is a comparatively highly developed Himalayan and S. Chinese modification of the *macrotis* type.

Ganges Valley: — *Rh. lepidus*; *Rh. mitratus*. — The former is a very primitive (perhaps the most primitive) member of the *lepidus* group; the latter a representative of the *philippinensis* group, much more closely related to the Indo-Austro-Malayan *Rh. philippinensis* and *achilles* (and the Ethiopian *Rh. Maclaudi*) than to the geographically nearer Himalayan form of the same group.

South India: — *Rh. Rouxi typicus*; *Rh. lepidus*; *Rh. Beddomei*. — *Rh. Rouxi* is no doubt an immigrant from the Himalayas, where identically the same race occurs. *Rh. lepidus* is also found in the Ganges tract. *Rh. Beddomei* is closely allied to *Rh. luctus* from Borneo and the Malay Peninsula.

Ceylon: — *Rh. Rouxi typicus*, common to Ceylon and S. India. (A bat of the *philippinensis* type occurs in Ceylon, presumably *Rh. Beddomei*; I have seen a very young individual only.)

Malabar Coast: — *Rh. gracilis*, a bat of the probably Himalayan *minor* type.

The Indian and Ceylonese Subregions. — Only five species occur, one of them (*Rouxi*) Indo-Chinese. *Rh. gracilis* points northwards; *Rh. mitratus* and *Beddomei* to the Indo-Malayan countries. One species (*Rh. lepidus*) may represent a purely autochthonous type.

Somaliland, Erythrea, Abyssinia, and Bahr-el-Abiad tract: — *Rh. clivosus, Rh. acrotis typicus*; *Rh. Andreinii, Rh. Dobsoni*; *Rh. hipposiderus minimus*; *Rh. fumigatus typicus*. — The first two species are modifications of the Himalayan *affinis* type. *Rh. Andreinii* (very closely related to *Rh. Blasii*) and *Rh. Dobsoni* (very close to *Rh. lobatus*) point back to the Himalayan *Rh. subbadius*. *Rh. hipposiderus* has no nearer known ally than the Persian *Rh. midas*, and the particular race (*minimus*) here under consideration is the same as now distributed over the Mediterranean countries. *Rh. fumigatus* is a very highly developed species of the Himalayan *macrotis* type.

Uganda :—*Rh. eloquens*, a bat of the *macrotis* type, in certain characters rather intermediate between *Rh. Hildebrandti* and *Rh. fumigatus*.

Ukambani tract and Zanzibar Coast :—*Rh. Deckeni*; *Rh. lobatus*; *Rh. Hildebrandti*, *Rh. fumigatus exsul*.—*Rh. Deckeni* is an Ethiopian representative of the Oriental *ferrum-equinum* type. *Rh. lobatus* belongs to a small group of Ethiopian species (*Landeri-lobatus-Dobsoni*) which have their more primitive counterpart in the Himalayan *Rh. subbadius*. *Rh. Hildebrandti* and *fumigatus* can be traced back ultimately to a bat like *Rh. macrotis*.

Zambesi tract :—*Rh. simulator*, *Rh. Darlingi*, *Rh. augur zambesiensis*; *Rh. lobatus*, *Rh. empusa*; *Rh. Hildebrandti*.—*Rh. simulator* is a bat of the *borneensis* type; *Rh. Darlingi* of the Himalayan *affinis* type; *Rh. augur* of the Oriental *ferrum-equinum* type. *Rh. empusa* is an Ethiopian representative of the *Rh. Blasii* stage, which, however, again leads back to the Oriental *minor-subbadius* stage. The two remaining species (*lobatus*, *Hildebrandti*) are common to this and the foregoing tract.

Limpopo tract :—*Rh. augur typicus*; on the species, see Zambesi tract, above.

Zululand, Natal, Eastern Cape Colony :—*Rh. augur zuluensis*.—This small, but zoogeographically rather well-marked, district is inhabited by a special race of the widespread Ethiopian *Rh. augur*.

S.W. Cape Colony :—*Rh. capensis*, an Ethiopian representative of the Oriental *Rh. Rouxi* type.

Orange River tract :—*Rh. Denti*, *Rh. augur typicus*.—*Rh. Denti*, closely related to *Rh. simulator* from the Zambesi tract, is a bat of the *borneensis* type. On the affinities of *Rh. augur*, see the Zambesi tract above.

Benguela and Loanda :—*Rh. Darlingi*; *Rh. angolensis*; *Rh. æthiops*.—*Rh. æthiops* is a highly developed representative of the Himalayan *macrotis* type. *Rh. Darlingi* is common to this district and the Zambesi tract. *Rh. angolensis* is unknown to me (but see footnote above on p. 652).

Lower Guinea :—*Rh. Landeri*, closely related to the Eastern Ethiopian *Rh. lobatus* and *Dobsoni*, all of them bats of the Oriental *subbadius* type.

Gold Coast :—*Rh. alcyone*; unknown to me.

Gambia tract :—*Rh. Maclaudi*, a bat of the Indo-Malayan *philippinensis* type.

The Ethiopian Region :—19 out of 69 known * species

* Leaving the imperfectly known *Rh. angolensis* and the practically quite unknown *Rh. alcyone* out of consideration.

have as yet been recorded from the Ethiopian Region. To sum up the probable affinities of these species: *Rh. Denti* and *simulator* represent the *borneensis* type; *Rh. capensis* the *Rouxi* type; *Rh. clivosus*, *Darlingi*, and *acrotis* the *affinis* type; *Rh. augur* and *Deckeni* the *ferrum-equinum* type; *Rh. empusa* and *Andreinii* one branch, *Rh. Landeri*, *lobatus*, and *Dobsoni* another branch, of the *minor-subbadius* type; *Rh. hipposiderus* the *midas* type; *Rh. Maclaudi* the *philippinensis* type; *Rh. æthiops*, *Hildebrandti*, *eloquens*, and *fumigatus* the *macrotis* type.—Thus, the distribution of the primary groups of the genus within the Ethiopian Region is, broadly speaking, as follows:—the *simplex* group (8 species) from the Cape Colony to Lower Egypt (beyond the limits of the Region), and on the western side of the Continent as far north as Angola; the *macrotis* group (4 species) from Abyssinia to the Lower Zambesi, across the Continent to Angola; the *lepidus* group (4 species) in a broad tract across the Continent from about 15° N. to 20° S.; the *midas* group (1 species) confined to the extreme north-eastern corner; the *philippinensis* group (1 species) to the north-western corner (probably of wider distribution).—It is a matter of some zoogeographical importance that all the Ethiopian species of the genus *Rhinolophus*, without exception, also have representatives in the Oriental Region; but still more important is the fact that all the Ethiopian species have *more primitive* representatives in S. Asia or the Indo-Malayan Archipelago. In view of this, and bearing in mind that in the absence of all palæontological evidence we have to base our conclusions exclusively on what we know about the now-existing forms, we are justified in supposing that all the Ethiopian *Rhinolophi* are, in the last instance, derived from Oriental forms. The passage from the Oriental to the Ethiopian Regions must have been considerably easier in past times than now.

Eastern Egyptian Desert:—*Rh. acrotis Andersoni*. The species is Ethiopian.

Lower Egypt:—*Rh. acrotis brachygnathus*; *Rh. euryale judaicus*.—*Rh. acrotis* is undoubtedly an immigrant from the Ethiopian Region. *Rh. euryale* has come from the Asiatic side of the Mediterranean; examples from Lower Egypt are indistinguishable from the Palestine-Euphrates race; the species does not seem to have spread south of Lower Egypt.

The Mediterranean Subregion (exclusive of Lower Egypt):—*Rh. clivosus*, *Rh. ferrum-equinum* (*proximus*, *typicus*, and *obscurus*); *Rh. midas*, *Rh. hipposiderus minimus*; *Rh. Blasii*, *Rh. euryale*.—*Rh. clivosus* is known only from

the border districts of the Ethiopian and Palæarctic Regions (Red Sea coasts), *Rh. midas* from the shore of the Persian Gulf. These, as well as the four truly "Mediterranean" species, are undoubtedly of Oriental origin. Worth noticing is the close faunistic connexion between the Spanish Peninsula and N.W. Africa (Algeria): the same race (*obscurus*) of *ferrum-equinum*.

Central Europe:—*Rh. ferrum-equinum typicus*; *Rh. hipposiderus typicus*.—The Central European *Rh. hipposiderus* is slightly different from the Mediterranean form.

British Islands:—*Rh. ferrum-equinum*; *Rh. hipposiderus minutus*.—Both of the Central European species have reached the British Islands. *Rh. hipposiderus*, as being the more hardy of the two species, as having spread over the whole of England and to several places in Ireland, and as having become to a certain slight degree different from the continental form, was probably the earliest comer. The range of *Rh. ferrum-equinum* is restricted to the southern part of England.

The whole Area of the Genus.—All the now-existing species can be referred to six "types." All the types can be traced back to some part or other of the Oriental Region. From there they have spread eastwards as far as Eastern Australia and Japan, south-westwards over the whole of the Ethiopian Region, westwards to Southern and Central Europe.

LXXIV.—*On the Oscules of* Cinachyra. By R. Kirkpatrick.

[Plate XIV.]

While engaged in the investigation of specimens of *Cinachyra barbata*, Sollas, obtained by the 'Discovery' from the Antarctic, I was led to examine examples of that species obtained by the 'Challenger' from Kerguelen and described by Sollas in his Report on the Tetractinellida.

Specimens of this species are spheroidal or ovoidal in shape and with a root-tuft; the surface bristles with a pile-like coat of spicules, which are mostly protrienes. Arranged round the sides of the sponge are flask-shaped recesses with oval or circular orifice and with the margins guarded by a